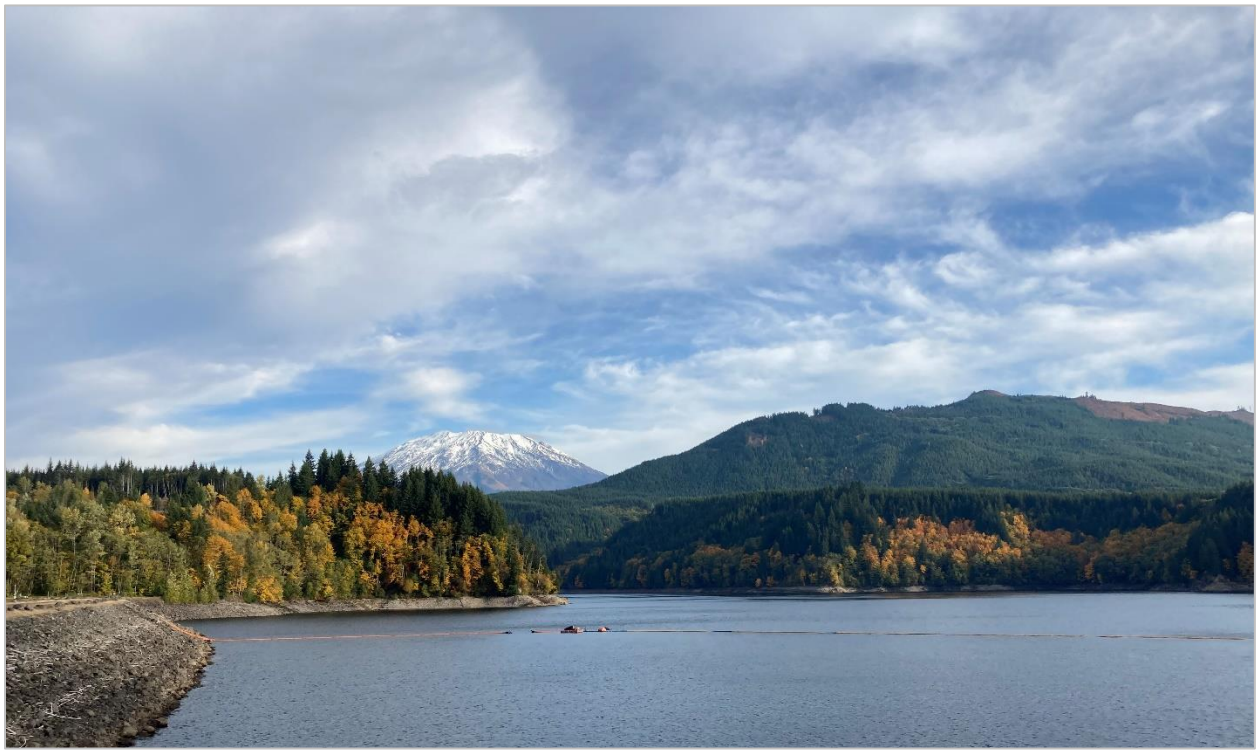
Aquatics Monitoring and Evaluation Program

2021 Annual Report (Final)

Lewis River Hydroelectric Projects
FERC Project Nos. 935, 2071, 2111 and 2213



View of Mt. Mount St. Helens from across Swift No1. Dam.
Photo by Chris Karchesky

PacifiCorp
&
Public Utility District No.1 of Cowlitz County

June 10, 2022

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

The purpose of this report is to document the results the Aquatics Monitoring and Evaluation Program associated with the Lewis River Hydroelectric Project (Project) in 2019. The Project begins approximately 10 miles east of Woodland, Washington (Figure 1.0-1), and consists of four impoundments. The sequence of the four Lewis River impoundments upstream of the confluence of the Lewis and Columbia rivers is: Merwin, Yale, Swift No. 2, and Swift No.1. These four impoundments are licensed separately by the Federal Energy Regulatory Commission (FERC). Merwin (FERC No. 935), Yale (FERC No. 2071), and Swift No. 1 (FERC No. 2111) are owned and operated by PacifiCorp. Swift No. 2 (FERC No. 2213) is owned by Public Utility District No. 1 of Cowlitz County (Cowlitz PUD) and is operated by PacifiCorp in coordination with the other projects. Combined, the Lewis River Project has a generation capacity of 606 megawatts.

On June 26, 2008, the FERC issued Orders approving the Settlement Agreement (SA) and granting new Licenses for PacifiCorp and Cowlitz PUD (Utilities) for operating the Project (PacifiCorp and Cowlitz PUD 2004). Among the conditions contained the SA was that the Utilities were to develop a master monitoring and evaluation plan (the M&E Plan) to implement the terms of Section 9 of the SA. The primary focus of the M&E Plan was to monitor and evaluate the effectiveness of aquatic Protection, Mitigation and Enhancement (PM&E) Measures, and to assess achievement of the Reintroduction Outcome Goals. Anadromous fish reintroduction goals were established in the SA for spring Chinook (*Oncorhynchus tshawytscha*) and coho (*O. kisutch)* salmon, and steelhead (*O. mykiss*) for the portion of the Lewis River located upstream of Merwin Dam. The overarching outcome goal for reintroduction identified in the SA is to:

> *"… achieve genetically viable, self-sustaining, naturally reproducing, harvestable populations of anadromous fishes above Merwin Dam greater than minimum viable populations."*

The intent of the M&E Plan was also to provide the methods to monitor and evaluate adult fish spawning escapement, fish passage facility hydraulic performance, flow and ramping rates, resident and anadromous fish interactions, and bull trout and kokanee populations.

The M&E Plan was to be developed in consultation with the Lewis River Aquatics Coordination Committee (ACC), and was to address the tasks, methods, frequency, and duration of those tasks necessary to accomplish the monitoring and evaluation items outlined in the SA (Sections 9.2 through 9.8). Performance standards defined in Section 4 of the SA provide the benchmark for the various M&E Plan items (Table 1.0–1). The original M&E Plan was finalized and approved by the ACC in June 2010 (PacifiCorp and Cowlitz PUD 2010). According to the SA, the Utilities shall Consult with the ACC as necessary, but no less often than every five years, to determine if modifications to the M&E Plan are warranted. The first revision of this plan was completed in 2017, and was fully implemented that year (PacifiCorp and Cowlitz PUD 2017). This version serves as the current M&E Plan for work conducted in 2021. It is worth noting that work began in spring 2021 to develop the second revision to the M&E Plan, and was still in development at the end of the year.

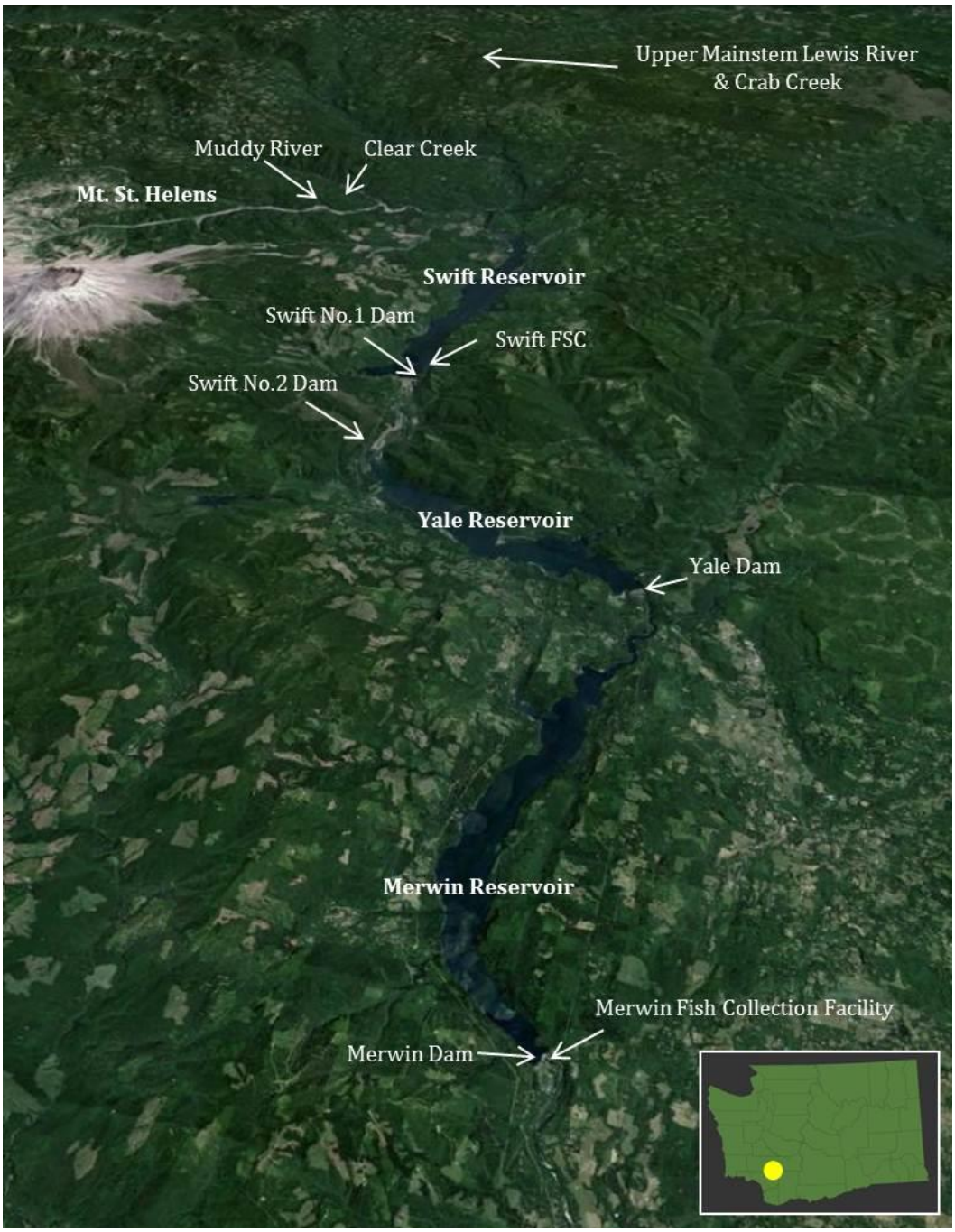


Figure 1.0-1. An overview of key features of the North Fork Lewis River Hydroelectric Project area located in southwest Washington.

Table 1.0–1. Reintroduction performance standard definitions and benchmark values.

Performance Standard	Definition[1]	Benchmark Value
Adult Trap Efficiency (ATE)	The percentage of adult Chinook, coho, steelhead, bull trout, and sea-run cutthroat that are actively migrating to a location above the trap and that are collected by the trap.	Determined by the ACC to be 98%
Collection Efficiency (CE)	The percentage of juvenile anadromous fish of each of the species designated in Section 4.1.7[2] that is available for collection and that is actually collected.	99.5%
Collection Survival (CS)	The percentage of juvenile anadromous fish of each of the species (designated in Section 4.1.7) collected that leave the Release Ponds alive.	Smolts > 99.5% Fry > 98% Adult Bull Trout > 99.5%
Injury	Visible trauma (including, but not limited to hemorrhaging, open wounds without fungus growth, gill damage, bruising greater than 0.5 cm in diameter, etc.), loss of equilibrium, or greater than 20% descaling . "Descaling" is defined as the sum of one area on one side of the fish that shows recent scale loss. This does not include areas where scales have regenerated or fungus has grown.	< 2% for smolts
Overall Downstream Survival (ODS)	The percentage of juvenile anadromous fish of each of the species designated in Section 4.1.7 that enter the reservoirs from natal streams and survive to enter the Lewis River below Merwin Dam by collection, transport and release via the juvenile fish passage system, passage via turbines, or some combination thereof (calculated as provided in Schedule 4.1.4. of the Settlement Agreement).	Interim > 80% > 75% after installation of Yale Downstream Collector
Upstream Passage Survival (UPS)	Percentage of adult fish of each species (designated in Section 4.1.7) that are collected that survive the upstream trapping-and-transport process. For sea-run cutthroat and bull trout, "adult" means fish greater than 13 inches in length.	> 99.5%
Active Tag	Tag type that detects and tracks movement of fish (e.g. radio tag, hydroacoustics tag)	N/A

1 Definitions are taken from Settlement Agreement for the Lewis River Hydropower Projects (PacifiCorp and Cowlitz PUD 2004)

2 Species designated in Section 4.1.7 of the Settlement Agreement are spring Chinook, winter steelhead, coho, bull trout and sea-run cutthroat trout.

2.0 Monitoring and Evaluation Objectives

The tasks, methods, frequency and duration of sampling, assumptions, and reporting requirements are outlined for twenty-two objectives in the M&E Plan. The objectives are as follows:

Objective 1 Quantify overall juvenile fish downstream survival (ODS) which includes reservoir survival, collection survival, transport survival, and survival at the release ponds

Objective 2 Quantify FSC collection efficiency

Objective 3 Quantify the percentage of juvenile fish available for collection that are not captured by the FSC and that enter the powerhouse intakes

Objective 4 Quantify juvenile and adult collection survival

Objective 5 Quantify juvenile injury and mortality rates during collection at the FSC (includes injury and mortality of adult bull trout, adult sea-run cutthroat, and steelhead kelts)

Objective 6 Quantify the number, by species, of juvenile and adult fish collected at the FSC

Objective 7 Estimate the number of juveniles entering Swift Reservoir

Objective 8 Develop index of juvenile migration timing

Objective 9 Quantify adult upstream passage survival

Objective 10 Quantify adult trap efficiency at each upstream fish transport facility (emphasizes analysis of the Merwin Adult Trapping Facility)

Objective 11 Quantify the number, by species, of adult fish collected at the projects (emphasizes Merwin Dam)

Objective 12 Develop Estimates of ocean recruits

Objective 13 Develop performance measures for index stocks

Objective 14 Document upstream and downstream passage facility compliance with hydraulic design criteria

Objective 15 Determine spawn timing, distribution and abundance of transported anadromous adults

Objective 16 Evaluate lower Lewis River wild fall Chinook and chum populations (*Note: Objective 16, because it is a lower Lewis River monitoring activity, was moved in the 2017 from the M&E Plan to become Objective 16 in the Hatchery and Supplementation Plan – see M&E Plan Objective 21 below.)*

Objective 17 Monitor bull trout populations

Objective 18 Determine Interactions between reintroduced anadromous salmonids and resident fish (Upstream of Merwin Dam)

Objective 19 Document Project compliance with flow, ramping rate and flow plateau requirements

Objective 20 Determine when reintroduction outcome goals are achieved

Objective 21 Develop a Hatchery and Supplementation Plan (H&S) to support and protect Lewis River native anadromous fish populations and provide harvest opportunity

Objective 22 Develop a Coordination Table that cross-references Objectives of the Hatchery and Supplementation Plan and the Monitoring and Evaluation Plan

All annual reporting for M&E Plan objectives is contained is this report. However, the National Marine Fisheries Service (NMFS) has designated anadromous fish populations for the North Fork Lewis basin that include naturally produced fish from the entire North Fork Lewis basin (i.e., both upstream and downstream of the Project). Therefore, evaluation of the anadromous fish reintroduction program, as measured by population status, requires that data collected from the monitoring efforts outlined in the M&E Plan be combined with those in the Lewis River Hatchery and Supplementation (H&S) Plan (PacifiCorp Energy and Cowlitz PUD 2020). The development of the H&S Plan monitoring objectives are summarized in the M&E Plan as part of Objective 21. The results of the H&S Plan are reported annually in the H&S Program Annual Operations Report, which is a standalone document for reporting.

The Lewis River Fish Passage Program Annual Report documents the results of various monitoring objectives related to evaluating the anadromous fish reintroduction program and outcome goals. The 2021 annual report can be found in Appendix A of this report.

Monitoring of bull trout (*Salvelinus confluentus*) populations affected by the Project is stipulated in Objective 17 of the M&E Plan. The goals of this monitoring program are to: 1) inform management decisions; and 2) provide information to assist in gauging whether recovery goals and objectives for bull trout are being met. The Lewis River Bull Trout Annual Operating Plan identifies the specific monitoring actions that will be implemented by the utilities each year to achieve the monitoring objectives. Each year the plan is developed in consultation with the United States Fish and Wildlife Service (USFWS) and the Lewis River Bull Trout Recovery Team (LRBTRT). The Lewis River Bull Trout 2021 Annual

Operations Report can be found in Appendix B of this report. The Lewis River Bull Trout 2022 Annual Operation Plan is provided as Appendix C.

Since 1979, PacifiCorp biologists, along with various state and federal agencies, have conducted annual surveys to estimate spawning escapement of kokanee in Cougar Creek, a tributary to Yale Reservoir. This annual monitoring effort, which is stipulated in Section 9.7 of the SA, continued in 2021. The Yale Reservoir Kokanee 2021 Escapement Report is provided as Appendix D.

Table 2.0-1 below summarizes each of the M&E Plan objectives, any performance goal stipulation, current methods for assessment, and results for the 2021 monitoring period. Table 2.0-1 also includes a reference for each objective on where the reporting can be found in more detail, and whether the objective is related to monitoring work being completed through the H&S Plan. A similar reference is provide for each objective associated in the current H&S Plan (PacifiCorp and Cowlitz PUD 2020) in Table 2.0-2.

Table 2.0-1. Coordination table summarizing the Monitoring and Evaluation Plan objectives in 2021.

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 1 Task 1.1	Estimate Overall Downstream Survival (ODS) for anadromous fish species above Swift No. 1 Dam	Juvenile ODS ≥80.0%	ODS is currently measured from the head of Swift Reservoir to the exit of the Release Ponds located downstream of Merwin Dam for coho, spring Chinook, steelhead and sea-run cutthroat trout using PIT tag mark-recapture methods. Survival probability through the reservoir and to capture at the FSC (S_1), collection survival (S_{COL}), and transport survival (S_{TRAN}) were multiplied and used to estimate ODS for each species.	Estimated 2021 ODS: Coho = 28.2% ± 2.2% Chinook = 22.1% ± 11.3% Steelhead = 17.4% ± 2.6% Cutthroat = 5.3% ± 4.6%	In 2020, all estimates of ODS were below the ≥80.0% performance goal. A total of 1,627 Coho, 58 Chinook, 813 Steelhead, and 93 Cutthroat were tagged and released for the ODS study. Of these fish, 468 Coho, 15 Chinook, 147 Steelhead, and 5 Cutthroat were recaptured at the FSC and passed downstream. These out-migrants were used to calculate ODS.	Annual Fish Passage Program 2021 Annual Report	Not Related

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 2 Task 2.1	Estimate Swift Floating Surface Collector (FSC) Collection Efficiency (Pce)	Juvenile Pce ≥95.0%	Collection efficiency (Pce) at the FSC is currently measured using fish tagged with biotelemetry tags (radio or acoustic) and released at the head of Swift Reservoir. Tagged fish that subsequently enter the Zone of Influence (ZOI) near the entrance of the FSC are considered available for collection. The proportion of those fish that are subsequently captured in the FSC is Pce.	Estimated 2021 Pce: Coho = 40% ±6% Chinook = 52% ±16% Steelhead = 48% ±7%	In 2021, Pce was evaluated with acoustically tagged coho, Chinook, and steelhead out-migrants. A total of 443 fish were tagged and release as part of this effort. The 95% performance standard was not met for any species in 2021. Overall estimates of Pce for all three species were consistent with previous years, however a more refined evaluation of where fish were rejecting the fish passage channel revealed that the vast majority of fish were "turning around" after passing through the secondary screen channel instead of being captured. It was thought that fish can rest in downstream area of the channel before attempting to exit back into the reservoir. PacifiCorp plans to retest collection efficiency through an acoustic tag study in the spring of 2022.	Annual Fish Passage Program 2021 Annual Report	Not Related
M&E - 3 Task 3.1	Quantify the percentage of juvenile fish available for collection that are not captured by the Swift FSC and that enter the powerhouse intakes	Monitoring	Not be quantified until downstream collection facilities are installed at Yale and Merwin Dams. Once these facilities are operational, the M&E Plan will be updated to include study protocols to determine turbine entrainment and loss.	Not required to be monitored in 2021	Assessing the proportion of fish entering the intake of the Swift No.1 Powerhouse is required under Section 9.2.1(f) of the SA and identified as Objective 3 of the M&E Plan. However, this M&E Objective will not be quantified until downstream passage facilities are installed at Yale and Merwin Dams.	Annual Fish Passage Program 2021 Annual Report	Not Related

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 5 Task 5.1	Determine Collection Injury Rate at the Swift FSC (P_{CINJ}) for juvenile salmonids and adult bull trout and steelhead kelts	Injury rate ≤2.0% for all fish examined	Injury rates are determined by daily examination of sampled fish captured in the Swift FSC.	Estimated 2021 S_{CINJ}: Coho (Fry) = 0.0% ± 0.0% Chinook (Fry) = 0.0% ± 0.0% Steelhead (Fry) = 0.0% ± 0.0% Cutthroat (Fry) = 0.0% ± 0.0% *COMBINED Fry: 0.0% ± 0.0%* Coho (Smolt)= 1.2% ± 0.1% Chinook (Smolt)= 7.7% ± 1.0% Steelhead (Smolt)= 1.2% ± 0.4% Cutthroat (Smolt)= 0.0% ± 0.0% *COMBINED Smolt = 1.6%±0.1%* Steelhead (Adult/Kelts) = 0.01% ± 0.01% Bull Trout = 0.0% ± 0.0%	Combined annual injury rates for each target species ranged from 0 to 7.7 percent. Overall, combined annual injury rates did meet the required performance standard of ≤ 2.0%. . Periodic debris accumulation in both the smolt flume and fish holding tanks during the spring out-migration period was attributed to higher than normal injury rates for spring Chinook in early 2021.	Annual Fish Passage Program 2021 Annual Report	Not Related

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 6 Task 6.1	Calculate juvenile and adult collection numbers using Swift FSC subsampling	Monitoring	The total number of fish collected is determined through directing fish into subsampling tanks for physical enumeration. Subsampling rate is based on the amount of time fish are directed into subsampling tanks by automated gates and expanded based on the total amount of time the FSC is operated within a discrete time interval	Estimated Total Juvenile: Coho = 70,672 (juv), 1,038 (adult) Chinook = 3,204 (juv), 0 (adult) Steelhead = 5,788 (juv), 35 (kelt), 50 (fall back adult) Cutthroat = 3 (fry), 731 (<13"), 26 (>13") Bull Trout = 6	A total of 85,693 (95% CI range: 70,621 – 100,765) salmonids were captured by the Swift FSC in 2021. Of these fish, approximately 81,295 were transported and released downstream of Merwin Dam. A sampling rate of 25% was preformed from May 4, 2021 through June 30, 2021, and again from November 17, 2021 through December 8, 2021. During the rest of the season, all daily count was counted by census (i.e., no subsampling).	Annual Fish Passage Program 2021 Annual Report	H&S Objective 14
M&E - 7 Task 7.1	Estimate the timing and number of juvenile salmonids entering Swift Reservoir from the Upper North Fork Lewis River subbasin	Monitoring	Operate screw trap located at the head of Swift Reservoir from approximately March 23 through June 30, 2021 to estimate number of out-migrates entering the reservoir by estimating trap efficiency using mark-recapture. Because unsampled periods and reservoir tributaries are not accounted for in this analysis, this information serves as an annual index that could be compared over the same general time period among years.	Mean Bootstrap total estimates: Coho = 97,761 (peak in mid-Jun) Chinook = 1,451 (peak in mid-June) Rainbow/Steelhead = 19,520 (variable, fry peak in early-July Cutthroat = 3,455 (variable) Bull Trout = 1,471 (variable)	The screw trap was operated continuously at Eagle Cliff from March 23 to July 30, 2021 and checked daily. Just over 2,600 naturally produced salmonids were captured in 2021. Approximately 74% of Coho, and 76% of Chinook were less than 80 mm FL; 60% of rainbow trout/steelhead were < 100 mm FL. Data suggest that during the 2021 monitoring period, most juvenile Coho (age 1 and 2+) passed the trap in May, while most subyearling Coho (age 0+) passed the trap in June and July as did subyearling Chinook. Oy-migrating Steelhead/Rainbow, Cutthroat, and Bull Trout passed the trap mostly in April and May, and fry in July after emergence began.	Annual Fish Passage Program 2021 Annual Report	Not Related

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 7 Task 7.2	Estimate the number of juveniles entering Swift Reservoir	Monitoring	Mark-recapture estimate of total juveniles that enter Swift Reservoir relies on PIT tagged fish marked at the Eagle Cliff screw trap (Task 7.1 above) as well as additional fish PIT tagged at the Swift FSC that released at the head of Swift Reservoir, and subsequently recaptured at the Swift FSC	Total estimates (not including fish ≤60 mm FL): Coho = 241,397 ± 18,227) Chinook = 13,057 ± 5,908) Steelhead = 31,914 ± 4,856) Cutthroat = 17,453 ± 22,477)	Total estimates only consider fish parr size and greater (i.e., >60 mm FL), which could be PIT tagged. Comparing these estimates to the number of juveniles estimated to pass Eagle Cliff during screw trapping operations in 2021 (Task 7.1 above) suggest that the majority of juvenile fish enter Swift Reservoir during times when the screw trap was not in operation and/or from other reservoir tributaries located down-reservoir of the Eagle Cliff trap.	Annual Fish Passage Program 2021 Annual Report	Not Related
M&E - 8	Develop index of juvenile migration timing	Monitoring	The Lewis River Aquatic Coordination Committee (ACC) determined that, although this Objective was specifically called for in the Settlement Agreement, this metric is already covered by M&E Plan Objective 6 and does not need to be duplicated.	See M&E Plan Objective 6	Overall, the run timing in 2021 followed normal frequency distributions both in the spring and again in the fall, with peak migration occurring in late-May and a minor peak in late-November. It is important to note the Swift FSC remained off until late-October in 2021 due to construction activities. Approximately 60% of all fish collected at the Swift FSC in 2021 were collected between March 1 and June 30, while the remaining 30% were mostly caught in November. The Swift FSC was turned off during the summer months due to high water temperature.	Annual Fish Passage Program 2021 Annual Report	Not Related

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 9 Task 9.1	Quantify adult upstream passage survival (UPS)	UPS ≥ 99.5%	UPS for adult fish being transported upstream is measured through the direct enumeration of adult fish at the Merwin Fish Capture and Transport Facility (MFCF) and at the adult fish release site above Swift Dam. Any dead fish recovered at trapping or the release sites upstream were identified to species and examined for signs of physical injury, to the extent possible.	<u>Estimated 2021 UPS:</u> Coho (early - S) = 99.6% Coho (late - N) = 99.7% Spring Chinook = 99.7% W. Steelhead = 99.7% Cutthroat = 98.2% COMBINED = 99.6%	For the 2021 upstream passage season, 26 early (S) coho, 10 late (N) coho, 3 spring Chinook, 1 winter steelhead, and 3 cutthroat trout mortalities were observed. Nearly all (94%) of the mortality observed in 2021 occurred during the trapping process; very few fish died (n=3) during transport and at release.	Annual Fish Passage Program 2021 Annual Report	Not Related

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 10	Quantify adult trap efficiency (ATE) at each upstream fish transport facility	ATE ≥ 98%	ATE is defined as the percentage of adult fish that are actively migrating that are successfully captured. Mark-recapture of radio tagged adults is used to estimate collection efficiency. Fish that are collected at the trap or at downstream locations are then tagged and released back downstream to continue their upstream migration. A series of monitoring stations are deployed throughout the tailrace of Merwin Dam and inside the fish trap. These stations are used to characterize fish behavior and quantify passage success.	No evaluation for adult trap efficiency was completed in 2021.	In review of the past five years (2013 – 2019) of evaluation, the ACC determined that reliable operation of the facility's fish lift and conveyance system was the largest contributor to the success of fish being captured at Merwin Dam. In early 2020, PacifiCorp began reviewing possible alternative designs to the current lift and conveyance system, particularly aimed toward modifying the system's crowder that automatically crowds adults from the head of the fish ladder into the lifting hopper. PacifiCorp had begun the formal process of redesigning the facility's crowding mechanism in December 2020. While it was originally anticipated that a final design would be reach reached by late-2021 with construction occurring sometime in 2022, delays in the process occurred to the COVID-19 pandemic. It is currently anticipate that construction will now occur sometime during the summer of 2023. Once the redesigned crowder is in place, it is intended that the ATE studies will resume for the target transport species.	Annual Fish Passage Program 2021 Annual Report	Not Related

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 11 Task 11.1	Quantify the number, by species, of adult fish collected at Merwin Dam (MFCF)	Monitoring	Censes (direct count). The MFCF is operated and the number of fish recorded daily.	2021 MFCF Count: Coho (early - S) = 18,054 Coho (late - N) = 5,439 Spring Chinook = 2,359 Fall Chinook = 843 Summer Steelhead = 1,056 Winter Steelhead = 1,631 Cutthroat = 173 Sockeye Salmon = 1 Chum Salmon = 2 Pink Salmon = 2 Bull Trout = 0	A total 29,560 fish were captured at the MFCF in 2021.	Annual Fish Passage Program 2021 Annual Report	Not Related
M&E - 12	Develop estimates of ocean recruits	Threshold Levels for Ocean Recruit Hatchery Produced Adults: Spring Chinook = 12,800 Steelhead = 13,200 Coho = 60,000 Naturally Produced Adult: Spring Chinook = 2,977 Steelhead = 3,070 Coho = 13,953	Methods vary to estimate adult return sizes produced. The purpose behind this objective is largely to inform decisions about the size of the hatchery programing the future as natural production through reintroduction efforts is expected to increase. The ACC agreed to change the ocean recruits definition so that jacks are not included or counted as part of the ocean recruits analysis (March 9, 2005 ACC meeting).	Not completed in 2021	It will take at least five years of analysis before investigators can confidently report ocean recruit numbers and begin evaluating hatchery goals for the Lewis River. Since adult returns of natural-origin fish from the upper Lewis River have not occurred in numbers large enough for meaningful analysis, this metric will be postponed until larger natural-origin adult returns are realized.	Annual Fish Passage Program 2021 Annual Report	Related to hatchery production goal for target species if natural ocean targets met

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 13 Task 13.1	Develop performance measures for index stocks	Monitoring	Performance metrics are to be calculated for reintroduction species upstream of Merwin Dam. These metrics are intended to measure natural production performance, and can include adult and juvenile abundance, and their corresponding ratios for recruit per spawner, smolt to adult, and smolt per spawner. The H&S Plan recommends that other Lower Columbia River stocks be used as index groups to determine whether the success or failure of the Lewis River reintroduction program is the result of in-basin or out-of-basin factors. This would be determined by comparing the survival rates of hatchery and natural-origin fish produced in other basins (such as the Cowlitz River) with releases made in the Lewis River.	*Performance Metrics for Natural Origin Adults Returning in 2021* Smolt to Adult Return (SAR) Coho = 6.2% Winter Steelhead = 5.9% Spring Chinook = *NA* Recruit per Spawner (R/S) Coho = 0.24 Winter Steelhead = 0.30 Spring Chinook = *NA* Smolt per Spawner (Smolt/S) Coho = 16.1 Winter Steelhead = 20 Spring Chinook = *NA*	In past years (pre-2019) adult returns of natural-origin (NOR) fish from the upper Lewis River had not occurred in numbers large enough for meaningful analysis of metrics related to performance. However in 2020, and again in 2021, there were sufficient numbers of returning NOR coho and winter steelhead returning from the upper basin above Swift Dam to make some inference on metrics related to performance. There were not enough returning natural origin spring Chinook from the upper basin in 2021 to perform any meaningful analyses. Based on metrics related to performance, it appears that for both populations, replacement still was not achieved in 2021. However, recruitment for the NOR stocks was considerably higher compared complementary Lewis River hatchery origin populations of the same species returning in 2021.	Annual Fish Passage Program 2021 Annual Report	Not Related

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 14 Task 14.1	Document upstream and downstream passage facility compliance with hydraulic design criteria	Verification	The objective of the hydraulic evaluation was to verify that the performance of the built passage facilities met the performance goals set for the design by NMFS criteria. The hydraulic evaluation for the Swift FSC was completed in 2013; and, for the MFCF, completed in 2014.	Both the Swift FSC and MFCF met the design intent and specified criteria for hydraulic performance.	This task is complete until additional fish passage facilities have been constructed.	2012 Hydraulic Evaluation of Swift Reservoir Fish Screen (Alden and R2 Resources 2013) Hydraulic Evaluation Report - MFCF (MWH 2014)	Not Related
M&E - 15 Task 15.1	Determine spawner abundance, timing and distribution of transported anadromous adults (spring Chinook and coho)	Monitoring	The Lewis River Aquatics Coordination Committee – Aquatic Technical Subgroup (ATS) decided in 2021 that Coho and Chinook spawning surveys should focus on distribution rather than spawner abundance. Therefore, spawning surveys were conducted across as many reaches as possible each month (census survey) in 2021 rather than a subsample of reaches as was conducted in previous years.	<u>2021 Estimates:</u> Coho redds counted = 791 (census) Spring Chinook redds counted = 240 (census)	Most spring Chinook redds were counted in the mainstem of the North Fork Lewis River (78 percent), followed by Clearwater Creek (14 percent), Little Creek (4 percent), Clear Creek (2 percent), and the Muddy River mainstem (2 percent) during the month of September. In aggregate, the most Coho redds were counted in the NF Lewis River mainstem and small tributaries (39 percent), followed by the aggregate of Swift Reservoir small tributaries (29 percent). The distribution pattern of both Coho and Chinook redds counted in 2021 is consistent with the prior observations from all other years combined.	Annual Fish Passage Program 2021 Annual Report	H&S Objective 15

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 15 Task 15.2	Determine spawner abundance, timing and distribution of transported anadromous adults (winter steelhead)	Monitoring	Due to limited access and anticipated heavy snow accumulations during the spawning season for winter steelhead, a combination of aerial radio telemetry surveys, fixed-station radio antennas, aerial red counts, and single pass electrofishing surveys for young-of-the-year steelhead (during the following summer) are used.	Summary of 2021 winter steelhead redd counts of Swift Reservoir immediate tributaries Swift Creek = 15 Diamond Creek = 0 Range Creek = 0 Drift Creek = 1 S10 = 0 S15 = 3 S20 = 0 TOTAL = 19	Aerial surveys scheduled to detect the distribution of spawning radio tagged winter steelhead in the upper basin above Swift Dam were canceled due to COVID-19 restrictions. Because of this cancellation, winter steelhead were not radio tagged in 2021. However, winter steelhead spawning "ground" surveys were conducted on immediate tributaries to Swift Reservoir. Seven different surveys were performed from April 15, 2021 through June 15, 2021. A total of 19 winter steelhead redds were observed throughout the surveyed reservoir tributaries in 2021. Spawning occurred from mid-April through the mid-June with peak spawning activity taking place during the last two weeks of May. Swift Creek accounted for the majority (79 percent) of the observed winter steelhead redds in 2021.	Annual Fish Passage Program 2021 Annual Report	H&S Objective 15

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 16	Evaluate Lower Lewis River wild fall Chinook and chum populations	Monitoring	See H&S Plan (2014) Objective 16	See H&S Plan Annual Report (2021) Objective 16	The ACC made a decision to separate tasks originally identified in the Settlement Agreement into monitoring upstream of Merwin dam (M&E Plan Tasks) and monitoring downstream of Merwin dam (H&S Plan Tasks). Because of that distinction, this section, which is a downstream activity, has been transferred to the H&S Plan.	Hatchery and Supplementation Program 2021 Annual Operations Report	H&S Objective 16

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 17	Monitor bull trout populations	Monitoring	In 2021, monitoring included: Swift Reservoir bull trout survival estimate; redd surveys in Pine, Rush and Cougar creeks, and the mainstem upper Lewis River; operation of PIT antennas in selected areas; video camera monitoring in Cougar Creek; temperature monitoring of spawning streams; Yale Tailrace bull trout capture and transport upstream; and Swift Bypass Reach capture and PIT tag.	Survival estimates in Swift Reservoir remained stable for bull trout from 2019 to 2021. Redd counts were impacted by a high flow event in mid-October which impacted the ability to complete surveys and thus the ability to compare 2021 to prior years data. Installed temporary tributary PIT antennas operated throughout the spawning period with no interruptions, interrogations of tagged fish remained consistent with historical data collection. The weir and camera in Cougar Creek remained operable throughout the period of deployment, with numerous observations of migrating bull trout.	PacifiCorp and Cowlitz PUD are involved in various bull trout monitoring efforts in Cougar Creek in Yale Reservoir and in the North Fork Lewis River basin upstream of Swift Dam. The 2021 Bull Trout Annual Operations Report provides results for activities that were either ongoing or completed in 2021 as part of this M&E Plan Objective. All monitoring activities are developed annually in consultation with the USFWS and the LRBTRT and are outlined in the Lewis River Bull Trout Annual Operating Plan (2022).	Lewis River Bull Trout 2021 Annual Operations Report	H&S Objectives 1 & 13

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 18	Determine interactions between reintroduced anadromous salmonids and resident fish (upstream of Merwin Dam)	Monitoring	PacifiCorp to monitor the interaction between reintroduced anadromous salmonids and resident fish species. Of specific interest, is the possible effect resident trout released in Swift Reservoir may have on reintroduced salmonids and the effect of anadromous fish introductions on the kokanee populations in Yale Lake. Additionally, concern was expressed that anadromous fish may impact the health and viability of ESA listed bull trout populations. This task is one of the assignments of the Fish Passage Feasibility Study conducted by the US Geological Survey (USGS) and University of Washington (UW), Department of Fisheries. The final report was issued in December 2016 (PacifiCorp 2016).	In 2021, it was identified that some aspects of the 2016 USGS/UW resident/anadromous interaction study should be replicated given the fully operational status of the anadromous reintroduction program. The Lewis River Bull Trout Recovery Team (LRBTRT) was tasked with developing a Study Plan to assess interactions, and plans to implement this process in 2022.	The LRBTRT identified the tasks below to be completed in 2022: Provide proportional estimates of predation and consumption of juvenile anadromous salmonids by resident native species across different seasons using stable isotope analysis (SIA); Provide proportional estimates of predation and consumption of juvenile bull trout and resident native species by anadromous salmonids across different seasons using SIA; Provide estimates of potential competition among different resident species and anadromous salmonids for resources using SIA; Provide estimates of predation and competition among species in Pine Creek using SIA; and Provide estimates of predation and competition among species in Rush Creek using SIA.	Annual Fish Passage Program 2021 Annual Report	H&S Objectives 1 & 13

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 19	Document Project compliance with flow, ramping rate and flow plateau requirements	Monitoring	PacifiCorp agreed to document project flow, ramping rate, flow plateau, and flood storage requirements of the new License for the Project. The monitoring locations for stream flow-requirements are at the USGS Ariel Gage No. 14220500 downstream of Merwin Dam, and two sites in the Lewis River bypass reach below Swift No. 1 Dam. Flood storage requirements are monitored at each of the project dams.	Flow rates from the upper release point of the Bypass Reach were in excess of the required minimum flow for the duration of the year. There were two spill event at Swift No 1. Dam in 2021 resulting in TDG above 110%, however the 7Q10 for natural inflows was met in both cases. At the Constructed Channel, flows were maintained at the established set point of 14 cfs year round; no minimum flow excursions were recorded in the Constructed Channel in 2021. Tailrace flow below Merwin Dam met or exceeded the minimums as stipulated in the FERC license with noted exceptions outlined in the ACC/TCC 2021 Annual Report. There were no ramp rate excursions in 2021 downstream of Merwin Dam, as measured at the USGS Ariel Gage No. 14220500.	Details on reporting this objective in 2021 are contained the ACC/TCC Annual Report.	ACC/TCC 2021 Annual Report	Not Related

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 20	Determine when reintroduction outcome goals are achieved	Yet to be defined as a numeric adult goal that dictates when run-size is sufficient for achieving both recovery and harvest goals. Until the Services develop numeric goals, the natural adult abundance targets presented under M&E Plan Objective 12 (Ocean Recruits) will be used as the benchmarks for determining the success of the reintroduction effort.	Table will be jointly developed by PacifiCorp and the ACC	Not completed in 2021	The Lewis River Settlement Agreement notes: "…the Services, after discussion with the ACC, shall determine how they will assess whether Reintroduction Outcome Goals have been met, e.g., metric, model, qualitative factors ("Evaluation Methodology"). The determination shall take into account the variability of the factors influencing the success of the comprehensive aquatics program over time such as cycles of ocean conditions and will include an appropriate temporal component in developing and applying the Evaluation Methodology."	None	Not Related

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 21	Develop a Hatchery and Supplementation Plan	Develop and maintain H&S Plan	The H&S plan is revised and updated on a 5-year cycle . The current plan was updated and submitted to the FERC in December 2020. A major component of the H&S Plan is the creation of an Annual Operating Plan (AOP) that is generated by the Aquatic Technical Subgroup (ATS) and used as the reporting template each year.	Results from 2021 are contained in the Utilities 2021 Annual Operations Report (Attachment C). Results from monitoring in 2021 are summarized in Table 2.0-2 below.	The current version of the H&S Plan (2020) contains nine (9) objectives, and 23 key questions.	Hatchery and Supplementation Program Annual Operations Report	All

Objective No. /Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
M&E - 22	Develop a coordination table that cross references objectives of the H&S and Aquatic M&E Plans	Help support the develop of an annual coordination table using data collected by the M&E and H&S Plans to provide information about Viable Salmonid Population (VSP) metrics such as population abundance and productivity in coordination with WDFW.	Methodology necessary to combine data from both the M&E and H&S plans to develop annual point estimates with precision estimates for these metrics at the population scale has not been developed to date. Combining data to estimate these metrics at the population scale is necessary to fully evaluate the success of PacifiCorp funded reintroduction and hatchery production programs.	Not completed in 2021	The specific detailed methodology for developing metric estimates at the population scale and summary table format will be developed by WDFW and PacifiCorp and will be included as part of annual reporting for Objective 22. The threshold for developing population scale metric summaries will be the same as identified under Objective 12 for developing ocean recruit analysis under Section 2.12.1.2.	Annual Fish Passage Program 2021 Annual Report	All

Table 2.0-2. Coordination table summarizing the Hatchery and Supplementation Plan objectives in 2021.

Objective No. Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
H&S - 1	Evaluate the effects of hatchery plants on reintroduced species and bull trout	Monitoring	See Objectives 17 and 18 in the Aquatic Monitoring and Evaluation Plan (2016)	See Annual Fish Passage Program 2021 Annual Report	This objective was moved to the Aquatic Monitoring and Evaluation Plan in 2016, and is reported on in the Annual Fish Passage Program 2021 Annual Report.	Annual Fish Passage Program 2021 Annual Report	M&E Objective 17 & 18
H&S - 2	Determine adult composition proportion of hatchery origin spawners (pHOS) of late winter steelhead, coho and spring Chinook downstream of Merwin Dam	Based on HSRG guidelines, hatchery origin fish shall not make up more than 5 to 30 percent of the total natural spawning population depending on the designation of that population	Steelhead: Multi-state mark recapture model (Lebreton 2009) Salmon (Coho and Spring/Fall Chinook): Pooled carcass surveys to determine origin.	2021 late Winter Steelhead pHOS: Insufficient data to derive estimate 2021 Coho pHOS: Mainstem NF Lewis River including sampled tributaries: Total pHOS (pooled) = 80% 2021 Spring Chinook pHOS: 79% 2021 Fall Chinook pHOS: Tule = 54.2; Bright 2.0%; Combined = 11.8%		Hatchery and Supplementation Program 2021Annual Operations Report	M&E Objective 16

Objective No. Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
H&S - 3	Develop and monitor protocols to reduce hatchery effects on juvenile native and ESA listed species present downstream of Merwin Dam	Monitoring	The use of take surrogates is used to mitigate the potential for ecological interactions of hatchery released smolts on ESA listed species. These surrogate metrics include number, timing, location and smolt size at release.	Monitoring Indicators Evaluated include: Number of Smolts; Timing of Smolts Released; Location of Smolt Releases; Size of Smolts Released; Precocity Rates; and Migration Timing of Hatchery Released Smolts See H&S Objectives 6, 8 and 9 below for related data.		Hatchery and Supplementation Program 2021 Annual Operations Report	Not Related
H&S - 4	Estimate juvenile release behavior or residualism after release downstream of Merwin Dam	Monitoring	Not developed to date	Not implemented in 2021	Specific methods to quantify residualism after release from the Lewis River hatcheries have not been developed to date, and were therefore not implemented in 2021. However, the monitoring and use of several hatchery surrogate metrics has been included in the most recent draft of the H&S Plan (2020).	None	Not Related
H&S - 5	Produce an annual hatchery operations report	Annual Reporting	Annual report produced by WDFW as part of the Department's current hatchery operations contract.	Completed	The Annual Hatchery Operations report is provided in the Hatchery and Supplementation Program 2021 Annual Operations Report as Appendix G.	Hatchery and Supplementation Program 2021 Annual Operations Report	Not Related

Objective No. Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
H&S - 6	Monitor rearing conditions to be consistent with producing a high quality smolt that emigrates quickly with a relatively high rate of survival	Monitoring	Screw traps operated in the NF Lewis River below Merwin Dam are used to establish migration curves for hatchery released smolts. Once full cohorts are available for the spring Chinook rearing and release evaluation, survival will be reported for each treatment group and for all other available hatchery stocks using CWT recoveries. GSI and 11 kt analysis – evaluation of methods used to predict precocity was completed in 2021	Peak migration of hatchery released coho smolts occurs for approximately two weeks and correlates to the timing and duration of hatchery releases in April. A comparison of GSI and 11 Kt analysis yielded similar results, however 11Kt analysis appeared to be more sensitive and therefore a more desirable metric to predict precocity of spring Chinook		Hatchery and Supplementation Program 2021 Annual Operations Report	Not Related
H&S - 7	Monitor hatchery upgrades	Monitoring	Routine monitoring is provided through annual planning meetings with hatchery staff.	All projects as prescribed by the Settlement Agreement have been completed.	Upgrades include pond reconstruction, modification to intakes and sorting facilities and controls upgrades. All work prescribed by the Settlement Agreement were completed by 2015. Additional upgrades completed in 2021 are provided in Annual Hatchery Operations report, provided in the Hatchery and Supplementation Program 2021 Annual Operations Report as Appendix G.	Hatchery and Supplementation Program 2021 Annual Operations Report	Not Related

Objective No. Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
H&S - 8	Adopt release strategies that are consistent with HSRG and HGMP recommendations	Monitoring	Release strategies developed to conform to proposals contained in each HGMP and are intended to continue to conform with any HGMP modifications once approved by NOAA.	As a result of ongoing COVID-19 restrictions, on site morphology sampling did not occur for several rearing groups in 2021. No sampling of late coho or Chambers winter steelhead occurred during planned releases in April 2021. Sampling of pre and post release spring Chinook for releases in October 2021 and February 2022, and early coho in April 2021 occurred as normal. Analysis of CWT return data is not yet available for 2021 reporting		Hatchery and Supplementation Program 2021 Annual Operations Report	Not Related

Objective No. Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
H&S - 9	Monitor production levels and program release numbers	Monitoring	Annual meetings with hatchery staff and review of annual hatchery reports to ensure consistency with FERC production levels. All exceptions to these levels that occurred in 2021 are provided in Annual Hatchery Operations report, provided in the Hatchery and Supplementation Program 2021 Annual Operations Report as Appendix G.	<u>Production Numbers for the Lewis River Hatchery Complex (2021):</u> Spring Chinook = 1,321,373 smolts Coho = 1,957,690 smolts Winter steelhead = 104,424 smolts Late winter steelhead = 57,498 smolts Summer steelhead = 179,871 smolts Rainbow trout = 45,000. Kokanee = 11,807 lbs.		Hatchery and Supplementation Program 2021Annual Operations Report	Not Related
H&S - 10	Submit and gain HGMP approval for all hatchery programs on the Lewis River	Approval of HGMP	Submit HGMPs to NOAA for approval	Awaiting submittal to NOAA	No HGMP's were submitted to NOAA for approval in 2021	Hatchery and Supplementation Program 2021 Annual Operations Report	Not Related

Objective No. Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
H&S - 11	Routinely monitor effective population size for returning native winter steelhead and the potential for" Ryman-Laikre" effects on native winter steelhead population from supplementation activities.	Monitoring	Genetic sampling.	Awaiting data analysis by NOAA	Analysis of tissue samples submitted to NOAA has not yet been provided.	Hatchery and Supplementation Program 2021 Annual Operations Report	Not Related
H&S - 12	Develop sampling protocols for supplementation program returns to traps and from in-river capture	Monitoring	Development of methodologies are ongoing through the Hatchery and Supplementation Annual Operating Planning process. Anticipated to be included in the 2022 AOP	No data required	Sampling and handling protocols are currently being developed as part of the 2022 AOP. Once developed, these protocols will replace general sampling protocols included in previous versions of the AOP and annual operating reports. The new protocols will include guidance on data collection methodology, processes, storage, and responsibility to be assigned to various field crews. It is anticipated that the new protocols will be included in the 2022 AOP and reported on as part of the 2022 annual operations report.	Hatchery and Supplementation Program 2021 Annual Operations Report	Not Related

Objective No. Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
H&S - 13	Effects of upstream adult and juvenile supplementation on ESA listed species	Monitoring	See Objectives 17 and 18 in the Aquatic Monitoring and Evaluation Plan (2016)	See Annual Fish Passage Program 2021 Annual Report	This objective was moved to the Aquatic Monitoring and Evaluation Plan in 2016, and is reported on in the Annual Fish Passage Program 2021 Annual Report.	Annual Fish Passage Program 2021 Annual Report	M&E Objective 17 & 18
H&S - 14	Estimate juvenile and adult abundance of winter steelhead, coho and spring Chinook downstream of Merwin Dam	Monitoring	Steelhead Adults: Redd Survey using sex ratio and redd/female Salmon (spring Chinook & Coho) Adults: Carcass sampling using either total recoveries and expansion factor or mark-recapture methodologies (opercle tag) to estimate abundance (Jolly-Seber). Juvenile Salmon and Steelhead: Annually operate screw traps downstream of Merwin Dam to estimate out-migration timing and relative abundance.	Juvenile Abundance downstream of Merwin Dam (2021): NOR Coho = 63,781; NOR Chinook = 4,595,197 NOR Steelhead = 52,193 Spawning Survey Estimates downstream of Merwin Dam (2021): Late winter steelhead = 313 spawners Spring Chinook = 708 Fall Chinook = 15,848 Coho carcass in mainstem NF Lewis R. = 407 (*225-590 at 95% CL)*	Tandem screw traps were installed in the NF Lewis River near the Lewis River Golf Course and operated from March 1 to June 30, 2021. Redd and carcass surveys in the NF Lewis River below Merwin Dam followed existing protocols. The total coho carcass estimate within the lower NF Lewis River continues to be very low compared to the total number of coho captured at the Hatchery and Merwin traps	Hatchery and Supplementation Program 2021 Annual Operations Report	M&E Objective 6

Objective No. Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
H&S - 15	Determine spatial and temporal distribution of spawning winter steelhead, spring Chinook and coho downstream of Merwin Dam	Monitoring	Redd Surveys to identify location (GPS) and quantity (density and distribution metrics)	Mainstem NF Lewis R. downstream of Merwin Dam (2021): Coho Carcass total count: Reach 1 = 2 , Reach 2 = 2, Reach 3 = 0, Reach 4 = 32, Reach 5 = 28 Late winter steelhead redds per mile: Reach 1 = 9; Reach 2 = 76; Reach 3 = 18, Reach 4 = 58, Reach 5 = 11	Coho redd surveys were not conducted in 2021 for the mainstem NF Lewis River downstream of Merwin Dam due to the inability to differentiate coho redds from the much more numerous fall Chinook redds.	Hatchery and Supplementation Program 2021 Annual Operations Report	M&E Objective 15 Task 15.1 &Task 15.2
H&S - 16	Evaluate fall Chinook and chum populations downstream of Merwin Dam	Monitoring	Use of Jolly-Seber open population mark recapture model for abundance; including redd and live counts for spatial and temporal distribution	Mainstem NF Lewis R. downstream of Merwin Dam (2021): Fall Chinook 15,848 of which, 2,968 Tule, 12,880 Bright, and 708 Spring Chinook No Chum estimates were provided by WDFW	Detailed information regarding Chinook monitoring downstream of Merwin Dam is provided in the Hatchery and Supplementation Program 2021 Annual Operations Report as Appendix F.	Hatchery and Supplementation Program 2021 Annual Operations Report	M&E Objective 16

Objective No. Task No.	Objective Description	Performance Goal	Method	2021 Data	Summary	Results Source Reference	Relation between M&E and H&S
H&S - 17	Annual review of existing and proposed harvest regulations (if any) to determine if recommendations are warranted to protect supplementation program objectives	Review Annual Regulations	Review of published and proposed annual harvest regulations	No recommendations provided.	No recommendations were received by the ATS or ACC during 2021.	Hatchery and Supplementation Program 2021 Annual Operations Report	Not Related

3.0 LITERATURE CITED

Alden and R2 Resources. 2013. Hydraulic Evaluation of Swift Reservoir Fish Screens - 2012. Prepared by Alden Research Laboratories and R2 Resources for PacifiCorp. June 2013.

Lebreton, J., J.B. Nichols, R.J. Barker, R. Pradel, and J.A. Spendelow. 2009. Modeling Individual Animal Histories with Multistate Capture-Recapture Models. Advances in Ecological Research 41: 87-173.

MWH. 2014. Hydraulic Evaluation Report – Merwin Upstream Trap and Transport Facility. Prepared by MWH America, Inc. for PacifiCorp. September 2014.

PacifiCorp. 2016. New Information Regarding Fish Transport into Lake Merwin and Yale Lake. Prepared by Mason, Bruce & Girard, Cramer Fish Sciences, ICF International, D.J. Warren and Associates, Inc., and United States Geological Survey (USGS). Prepared for PacifiCorp. June 24, 2016.

PacifiCorp and Cowlitz PUD. 2004. Settlement Agreement for the Lewis River Hydroelectric Projects (Merwin – FERC Project No. 935; Yale - FERC

PacifiCorp and Cowlitz PUD. 2010. Aquatic Monitoring and Evaluation Plan for the Lewis River. Prepared by ICF, Bioanalysts, Meridian Environmental, Inc. R2 Resources Consultants, and Skalski Statistical Services for PacifiCorp Energy and Public Utility District No.1 of Cowlitz County. June 2010.

PacifiCorp and Cowlitz PUD. 2020. Lewis River Hatchery and Supplementation Plan. (FERC Project Nos. 935, 2071, 2111, 2213). Prepared by PacifiCorp and the Public Utility District No.1 of Cowlitz County. Version 3. December 2020.

PacifiCorp and Cowlitz PUD. 2017. Aquatic Monitoring and Evaluation Plan for the Lewis River. Prepared by PacifiCorp and the Public Utility District No.1 of Cowlitz County. Version 2. April 3, 2017.

APPENDICES

APPENDIX A

LEWIS RIVER FISH PASSAGE PROGRAM – 2021 ANNUAL REPORT

(SAVED AS SEPARATE FILE)

APPENDIX B

LEWIS RIVER BULL TROUT 2021 ANNUAL OPERATIONS REPORT

(SAVED AS SEPARATE FILE)

APPENDIX C

LEWIS RIVER BULL TROUT 2022 ANNUAL OPERATIONS PLAN

(SAVED AS SEPARATE FILE)

APPENDIX D

YALE RESERVOIR KOKANEE 2021 ESCAPEMENT REPORT

(SAVED AS SEPARATE FILE)